Bayou des Cannes
Watershed Implementation Plan

Standards, Assessment and Nonpoint Section
Louisiana Department of Environmental Quality

TABLE OF CONTENTS

Introduction

Section 303(d) of the Clean Water Act (CWA) requires states to identify waters that are not in compliance with water quality standards, establish priorities, and implement improvements. The TMDL program represents a shift in the way water quality is regulated (Boyd, 2000). Federal and state programs have traditionally focused on the regulation of point sources via technology-based standards to secure effluent reductions. Today, significant water quality improvement implies the expansion of controls to nonpoint sources of pollution (Boyd, 2000). Instead of focusing on releases from known point sources of water pollution, regulation and reporting will increasingly be concerned with the quality of waterbodies themselves.

The Louisiana Department of Environmental Quality (LDEQ) has been collecting water quality data in Bayou des Cannes since 1991. The early data indicated that dissolved oxygen levels in Bayou des Cannes (subsegment 050101) fall below 3.0 mg/L in the hot summer months. In 1993, Des Cannes was included in the List of Waterbodies Impacted by Nonpoint Source Pollution published in the LDEQ Nonpoint Source Assessment Report. This Report was based on the 1992 Water Quality Inventory 305(b) Report.

In 1996, LDEQ continued to document that Bayou des Cannes did not support primary contact recreation (e.g.: swimming) because of elevated levels of fecal coliform (a bacteria which may indicate the presence of disease-causing microbes). Nor was it in support of fish and wildlife propagation. The Bayou was subsequently listed on Louisiana's 1996, 1998, and 1999 Court Ordered §303(d) Lists. Suspected sources of impairment include oil and grease, organic enrichment/low dissolved oxygen (D.O.), pathogens, and turbidity. The Bayou was later de-listed for oil and grease and turbidity.

The LDEQ and the United States Environmental Protection Agency (USEPA) undertook modeling analyses for the lower Bayou des Cannes to quantify loadings in the water body and develop Total Maximum Daily Loads (TMDLs) for dissolved oxygen, nutrients, fecal coliform, and mercury. A TMDL specifies the amount of a particular pollutant that may be present in a waterbody, allocates allowable pollutant loads among sources, and provides the basis for attaining or maintaining water quality standards. The TMDL findings indicate that in order for the water body to meet the designated uses for fish and wildlife propagation, a 50-75% reduction of man-made nonpoint source pollution from agriculture, forestry, pastures and home sewage systems would be needed.

Water quality standards for bacteria have been promulgated by the State in order to protect the water bodies as well as public health. These standards are based upon fecal coliform bacteria, which may indicate the presence of other, potentially harmful microbes. Uses specific to Bayou des Cannes include primary contact recreation, secondary contact recreation, fish and wildlife propagation, and agriculture (LDEQ, 2002).

Primary contact recreation (PCR) includes recreation and other uses where there is prolonged body contact such as swimming and water skiing. Secondary contact recreation (SCR) is recreation and other uses where body contact is incidental such as fishing and boating. Propagation of Fish and Wildlife involves the protection of aquatic habitat, food, reproduction and travel corridors. Agriculture involves the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption.

Designated Use	Measured Parameter	Support Classification for Measured Parameter		
		Fully Supporting	Partially	Not Supporting
Primary Contact Recreation (PCR)	Fecal coliform[1]	0-25% do not meet criteria	-	>25% do not meet criteria
	Temperature	0-30% do not meet criteria	>30-75% do not meet criteria	>75% do not meet criteria
Secondary Contact Recreation (SCR)	Fecal coliform[1]	0-25% do not meet criteria	-	>25 % do not meet criteria
Fish and Wildlife Propagation (FWP)	Dissolved oxygen[2]	0-10% do not meet minimum of 3.0 ppm and median > criteria of 5.0 ppm	-	>10% do not meet minimum of 3.0 ppm or median < criteria of 5.0 ppm
	Dissolved oxygen[3]	0-10% do not meet criteria	>10-25% do not meet criteria	>25% do not meet criteria
	Temperature, pH, chloride, sulfate, TDS	0-30% do not meet criteria	>30-75% do not meet criteria	>75% do not meet criteria
Agriculture (AGR)	None	-	-	-

1. For most water bodies, criteria is as follows: PCR, 400 colonies/100 mL; SCR, 2,000 colonies/100 mL (see LAC 33:IX.1123).

2. Water bodies without a special study to establish specific criteria for D.O.

3. Water bodies for which a special study has been conducted to establish criteria for D.O.

What is a TMDL?

A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and assimilate while still meeting water quality standards. At the same time, it is also a measure of the total amount of pollutant that point sources are allowed to discharge into the waterbody. It determines the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant and establishes the load reduction necessary to meet a given standard (USEPA, 2001).

TMDL findings are based upon critical conditions. For oxygen demand TMDLs, low flow and warm temperatures define the critical condition. The TMDL is calculated for flow conditions of 7Q10. 7Q10 is a low stream flow measure (seven days, 10-year average low flow). It refers to stream flow that occurs over seven consecutive days and has a 10-year recurrence interval. Daily stream-flows in the 7Q10 range are indicative of drought conditions and generally occur during the critical summer months. During low flow conditions the impacts from pollutants may be magnified, as there is less water to dilute their effects. 7Q10 is a way to measure conservatively and may be thought of as a "worst-case-scenario".

The TMDL is comprised of a wasteload allocation (WLA), a load allocation (LA) and a margin of safety (MOS). The wasteload allocation is the load allocated to point sources/discrete dischargers. The load allocation is the load allocated to nonpoint sources/runoff. The margin of safety is a percentage of the TMDL that acts as a buffer, accounting for the uncertainties associated with the model assumptions and data inadequacies. The inclusion of the margin of safety in a TMDL calculation is a way to err on the conservative side. This conservative approach allows for model development errors and realistic future changes to be accommodated. For the purposes of the Bayou des Cannes TMDL, only one point source discharger, the town of Iota sewer treatment plant, was included in the wasteload allocation portion of the TMDL model (WLA + LA + MOS = TMDL).

Origin of Water Quality Data and TMDL Calculation

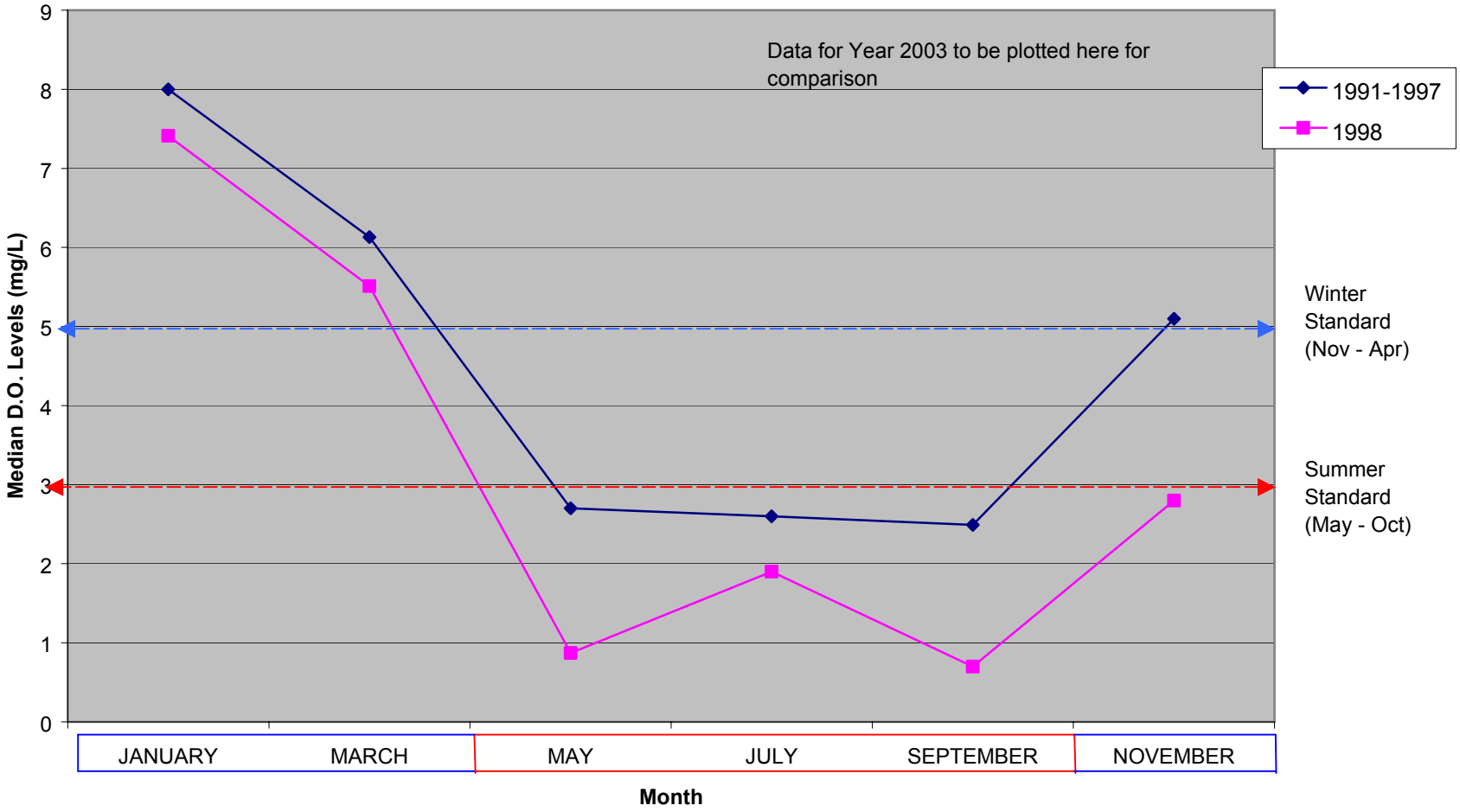
As part of the Statewide Water Quality Monitoring Network, LDEQ maintained a sampling station, site 0308, on Bayou des Cannes. Water quality data from this station were collected in odd number months from January 1991 to May 1998. The station is located at the Louisiana Highway 100 Bridge east of the town of Evangeline, Louisiana.

A second sampling station, site 0647, was in operation from June 1998 - December 1998. Site 0647 is also located on Louisiana Highway 100, within the town of Evangeline. Data was collected on a monthly basis here.

Data from these two sites were used to construct the graphs and charts found throughout this implementation plan.

From the graph that follows, it may be seen that D.O. declines throughout the year before it reaches a low from May through September. As the weather cools, D.O. begins to steadily climb. This trend was observed throughout the years of data collection. There is also a tendency for dissolved oxygen levels to hover beneath the summer standard of 3.0 mg/L during the warmer months.

Dissolved Oxygen Levels for Historical Data (1991-1997) v. the Last Year of Data Collection (1998)

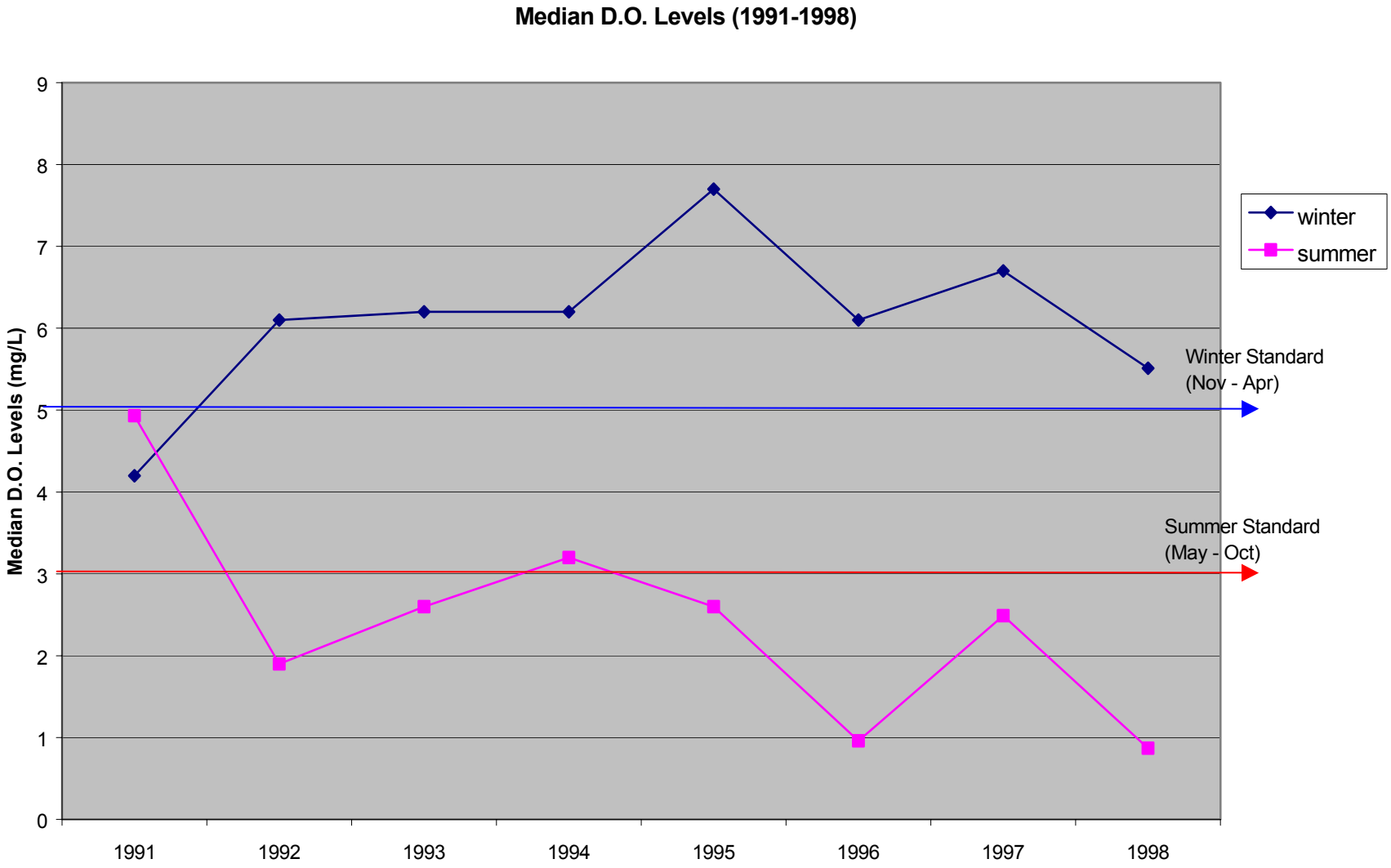


The LDEQ developed its TMDL for D.O. in Bayou des Cannes in 1999. Based upon the 1998 Use Attainability Analysis (UAA) for the Mermentau River Basin, the applicable D.O. criteria for the Bayou are 3.0 mg/L for the summer months (March through November) and 5.0 mg/L for the winter months (December through February). The TMDL model determined the reductions that would be necessary for Bayou des Cannes to comply with these established criteria (LeBlanc, 1999). The end goal of TMDL implementation is restored water quality in the impaired waterbody.
The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers (Mississippi and Atchafalaya) and Lake Pontchartrain are sampled throughout the five-year cycle.

Dissolved Oxygen

The LDEQ developed a dissolved oxygen TMDL for Bayou des Cannes in November 1999. The TMDL establishes load limitations for oxygen-demanding substances and goals for reduction of those polluting substances (LeBlanc, 1999). Typically, problems with low dissolved oxygen may be related to biochemical oxygen demand, sediment oxygen demand, temperature and nutrients. D.O. is highest when runoff is greatest, stream flow is high, and stream temperatures are low. (High runoff and stream flow will increase turbulence. Turbidity may negatively impact levels of dissolved oxygen.) D.O. problems are generally at their worst during dry summer seasons. In the Bayou des Cannes, stream flow and dissolved oxygen are greatest November through April.

Low levels of dissolved oxygen may diminish the habitat value of a waterbody. There may be a reduction in the abundance and diversity of adults, reduction in the growth rate of juveniles, and mortality for those species that move slowly. Those animals in the early life stages may be more prone to death. Low levels of D.O. will also compromise the vitality of aquatic life, reducing its resistance to disease (USEPA, no date). Oxygen concentrations greater than 5.0 mg/L are most beneficial for aquatic life.

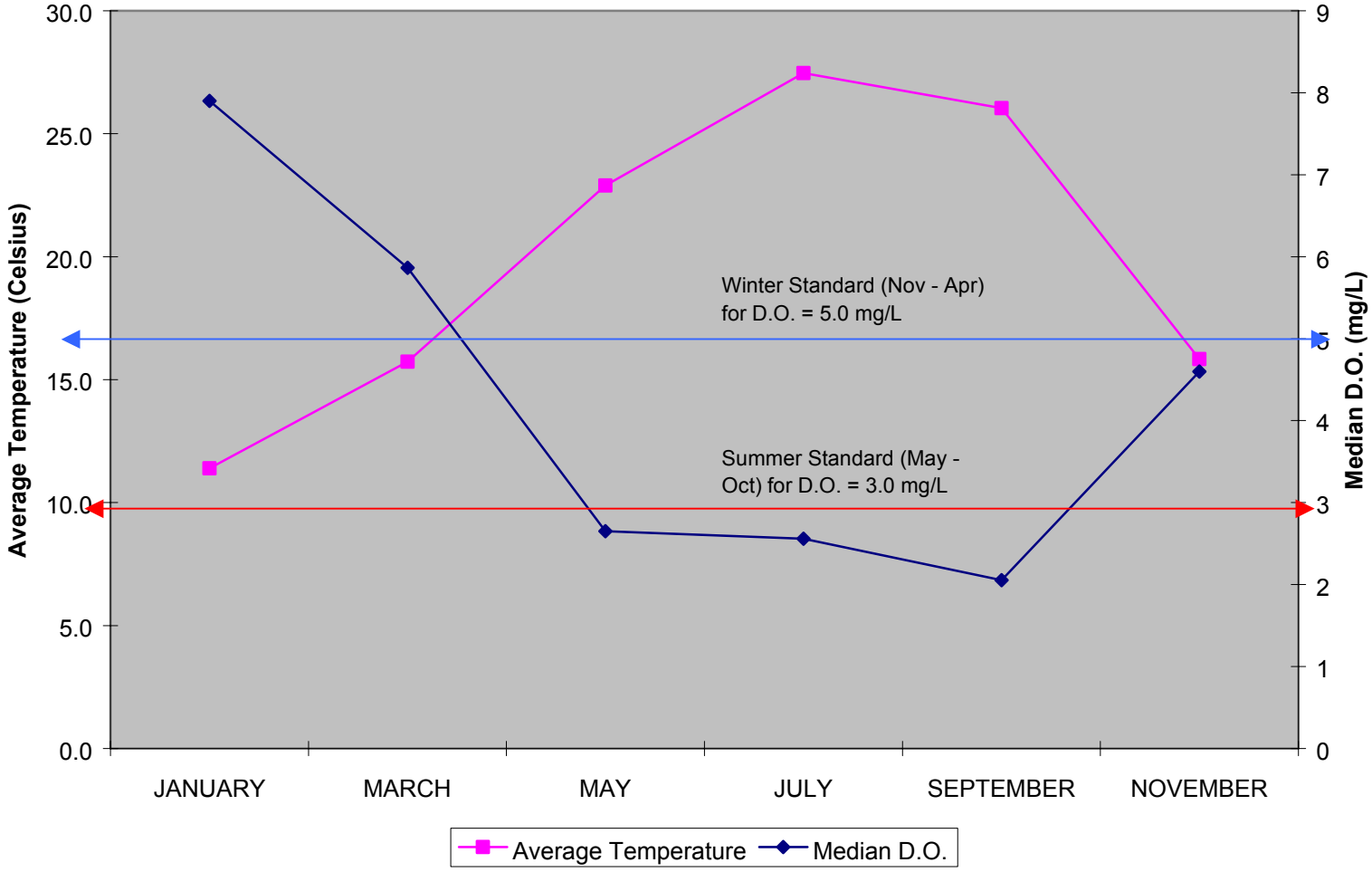

Median D.O. Levels (1991-1998)
Median D.O. Levels (mg/L)
0
1
2
3
4
5
6
7
8
9
1991
1992
1993
1994
1995
1996
1997
1998
winter
summer
Winter Standard
(Nov - Apr)
Summer Standard
(May - Oct)

At least some of this oxygen-deficient state is due to natural conditions in Bayou des Cannes. Like many of the water bodies in south Louisiana, the Bayou receives large amounts of natural organic material. The decomposition of this detritus and other organic matter may lead to low D.O. levels throughout much of the year. D.O. concentrations less than 5 mg/L may occur naturally during the warmer months. This concept will be discussed further below, in the ***Nutrients*** section.

In recognition of the natural state of Bayou des Cannes and similar waterbodies, a Use Attainability Analysis was approved for the Mermentau River Basin in 1998. D.O. recommendations for the Mermentau River Basin streams were assigned seasonally as 5 mg/L (December – February) and 3 mg/L (March – November). These D.O. standards were based on the existing D.O. criteria for similar waterbodies in Louisiana.

D.O. is most strongly affected by temperature, and there is a strong inverse correlation between temperature and D.O. As water temperatures increase, decay rates also increase. Decay occurs through the activities of microbes that populate the benthic load, those accumulated layers of sediment and sludge that blanket the streambed. Oxygen is demanded by these ubiquitous microbial colonies in order to fuel their biodegradation of organic matter. It is during periods of high temperature and low stream flow that the benthic load has its greatest and most disproportionately negative effect upon stream oxygen levels. This resuspended load is not associated with a flow. In the TMDL model, this benthic load is expressed as resuspended biological oxygen demand (BOD), sediment oxygen demand (SOD), and/or (CBOD).

Temperature & Dissolved Oxygen for the Historical Record (1991-1998)



Distribution of Load for Oxygen Demanding Substances in the Bayou des Cannes

Source	kg/day	Percent of total load
Nonpoint[1]	8777.00	38%
SOD[2]	1868.75	8%
Headwaters and tributaries[3]	1958.37	8%
Incremental[4]	1357.66	6%
Point Source[5]	9368.98	40%
Total	23330.75	100%

[1] Nonpoint load is the material running off the watershed into stream system.
[2] Sediment oxygen demand (SOD) is the benthic load that resides on the stream bottom.
[3] Headwaters and tributaries refer to the loading from tributaries and headwater.
[4] Incremental load includes ground water, rain events, and tributaries.
[5] Waste loads are the amount of pollutants discharged from industrial and municipal point sources in the waterway.

From the table above, it has been estimated that 46% of the water pollution problems in des Cannes may be related to nonpoint issues. In particular, the existence of the benthic material (SOD) is a chronic underlying problem, and its reduction is crucial to the successful attainment and maintenance of appropriate D.O. levels in Bayou des Cannes. It is hoped that adherence to recommended water quality standards, over time, will ultimately purge the accumulated layers of benthic material, and thereby decrease the demand for oxygen from the bottom layer. It appears that almost half of the water pollution issues in Bayou des Cannes could benefit from the modification of land use practices (e.g.: implementation of BMPs on agricultural lands).

Nutrients

Excessive discharges of nitrogen and other nutrients are also an important cause of low D.O. levels. Nitrogen fuels the growth of algae and aquatic plants. When these plants die, they settle to the bottom of the waterbody. Much decaying organic material is found in the benthic load. Here as it continues to decay, oxygen will be required for the biodegradation process.

At present, there are no specific numeric criteria for nutrients (e.g.: total nitrogen, total phosphorus, ammonia) in Louisiana. Nutrient criteria are tentatively slated for development by December 2004. However, the State currently has a narrative standard

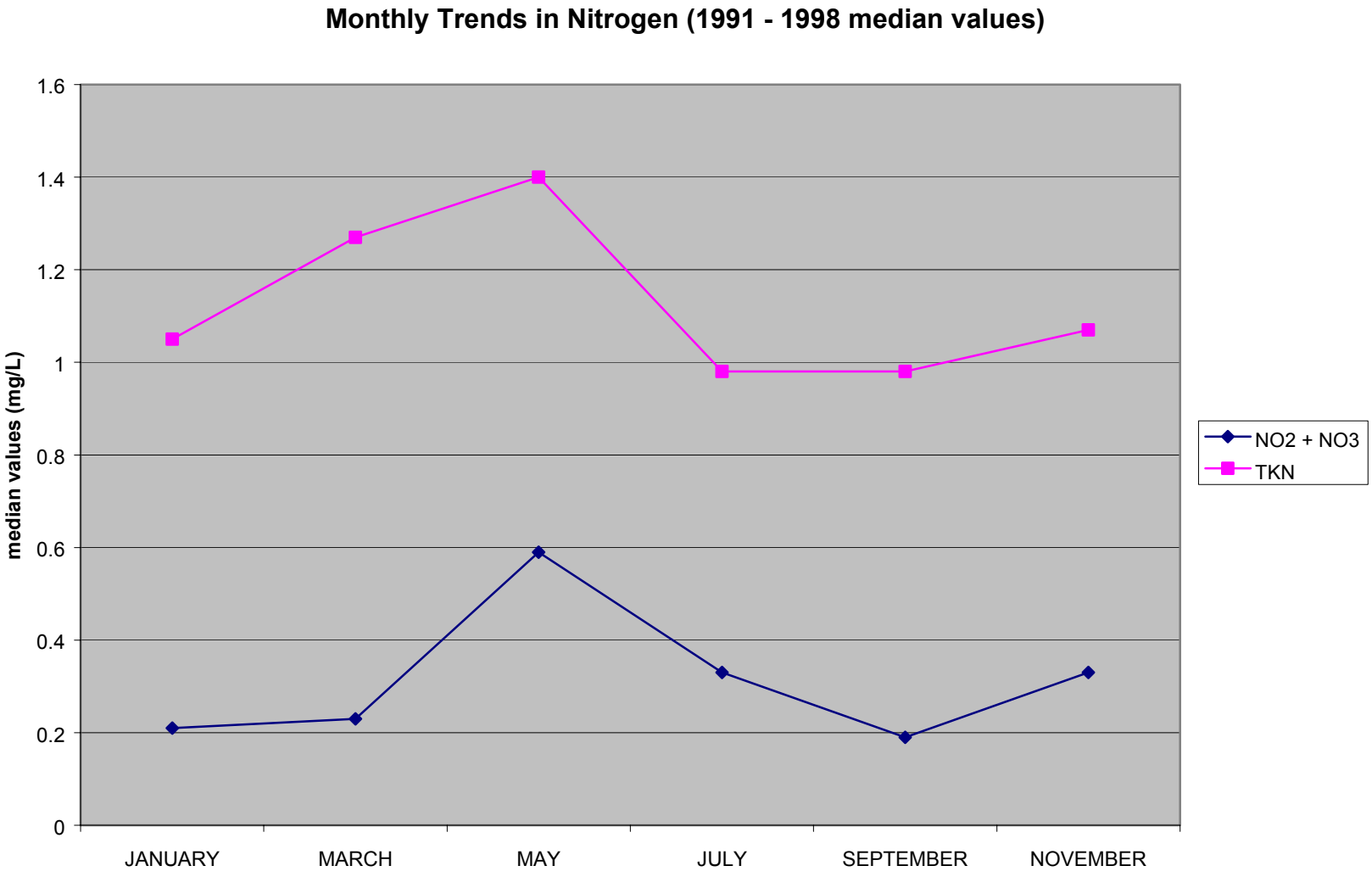
that states “The naturally occurring range of nitrogen-phosphorus ratios shall be maintained…Nutrient concentrations that produce aquatic growth to the extent that it creates a public nuisance or interferes with designated water uses shall not be added to any surface waters.”

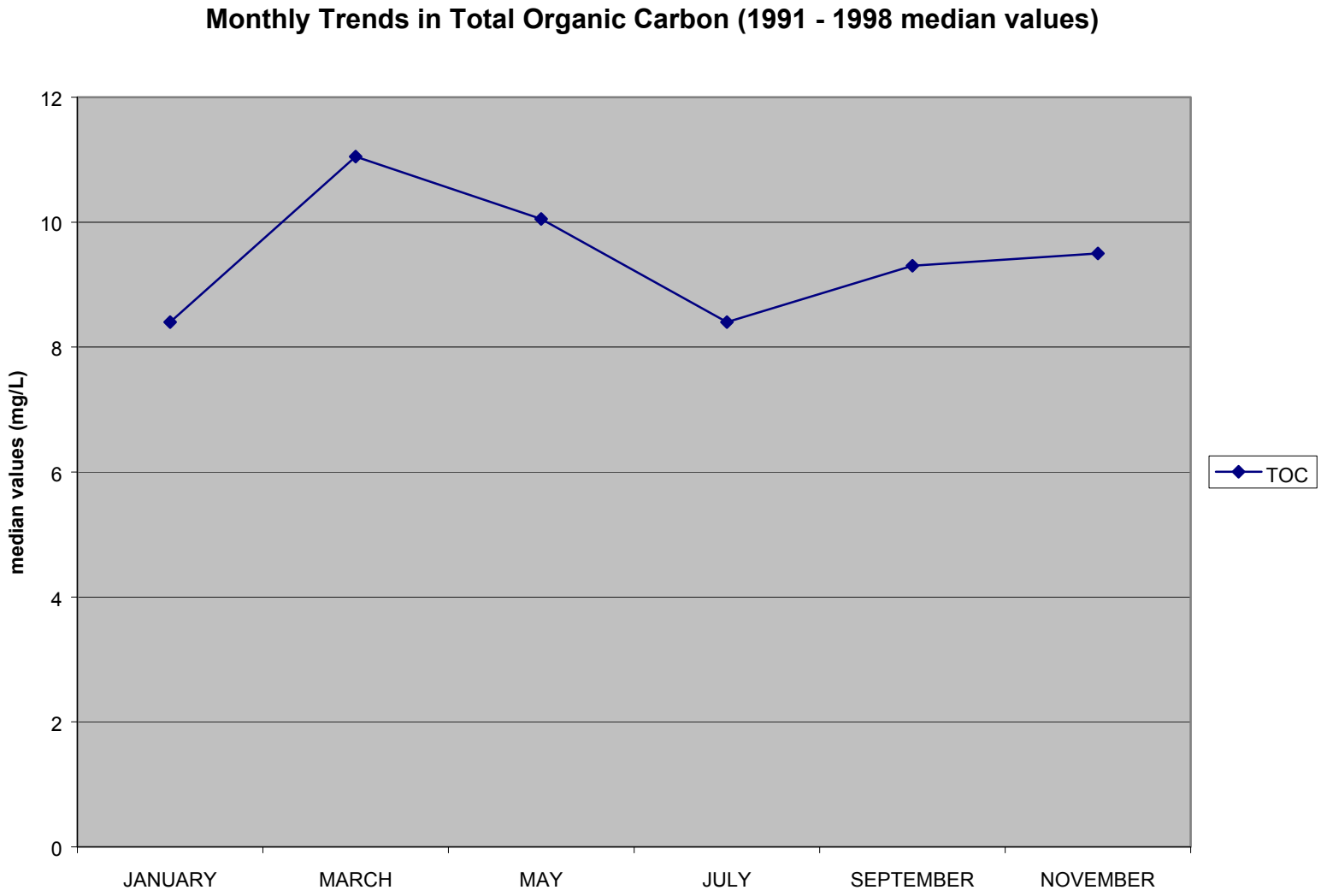
LDEQ has developed nutrient ranges for the different ecoregions of the state. Bayou des Cannes lies within the Western Gulf Coastal Plain ecoregion. The median phosphorus for this region is 0.184 mg/L; the median nitrogen is 1.29 mg/L. The 1991 – 1998 data for ambient site 0308 (northeast of Jennings, Louisiana) indicate that Bayou des Cannes often exceeded the median values for the Western Gulf Coastal Plain ecoregion for total nitrogen and total phosphorus.

USEPA has developed a TMDL for nutrients in Bayou des Cannes. It was the modeler’s determination that nitrogen-limiting conditions exist in Bayou des Cannes, as opposed to phosphorus-limiting conditions. Therefore the whole of the nutrient TMDL is concerned with nitrogen loading as it relates to the maintenance of the dissolved oxygen standard. It is believed that controls on nitrogen will maintain appropriate levels for other nutrients. Nonpoint sources of nitrogen include septic systems, wildlife, atmospheric deposition, dairy manure, poultry litter, grazing animals, and fertilizer applications. Whereas all of these potential sources do not exist in the Bayou des Cannes watershed, many of them do.

Eutrophication refers to the gradual increase in the concentration of nitrogen, phosphorus, and other plant nutrients in an aquatic ecosystem. It is a natural aging process of slow-moving bodies of water, such as the bayous of south Louisiana. However, this process may be accelerated by the addition of excessive nutrients, which in turn may stimulate algal growth. Even relatively modest increases in the concentration of nitrogen or phosphorous may be sufficient to trigger an "algal bloom". Excessive growth of algae may change water quality for the worst. These algal blooms lead to oxygen depletion and resultant fish kills. Organic and inorganic nutrient loads also provide an environment conducive to the proliferation of disease-causing microbes.

Having said this, it may be stated that Bayou des Cannes, like many of the water bodies in south Louisiana, is naturally dystrophic. Naturally dystrophic waters receive large amounts of organic material, primarily of plant origin. They are commonly stained by the decomposition of such organic material, and are low in D.O. These water bodies typically include or are surrounded by wetlands and have sluggish, low-gradient flows most of the year. Low D.O. concentrations may occur seasonally during the warmer months. Most of the Mermentau River Basin water bodies are surrounded by freshwater wetlands and exhibit naturally dystrophic water conditions (Day et. al., 1987, as cited in Office of Water Resources, 1998).


Monthly Trends in Nitrogen (1991 - 1998 median values)
median values (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
JANUARY
MARCH
MAY
JULY
SEPTEMBER
NOVEMBER
NO2 + NO3
TKN


Monthly Trends in Total Organic Carbon (1991 - 1998 median values)
median values (mg/L)
12
10
8
6
4
2
0
JANUARY
MARCH
MAY
JULY
SEPTEMBER
NOVEMBER
TOC

Fecal Coliform

EPA released its final Bayou des Cannes TMDL for fecal coliform (FC) in January 2001. Fecal coliform refers to a group of bacteria that is associated with the intestines of warm-blooded animals. It is generally monitored as an indicator of potential human health threats resulting from swimming. Testing for fecals is a good way to determine the presence of human and/or animal waste in a waterbody. Although the bacteria itself does not cause disease, its presence may indicate the presence of other pathogenic organisms that are harder to detect. Nonpoint sources of fecal contamination include wildlife, grazing livestock, land application of manure, pets, and failed septic systems. Louisiana has established a seasonal water quality standard for bacteria based upon definition of a summer swimming season and winter secondary contact only.

Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

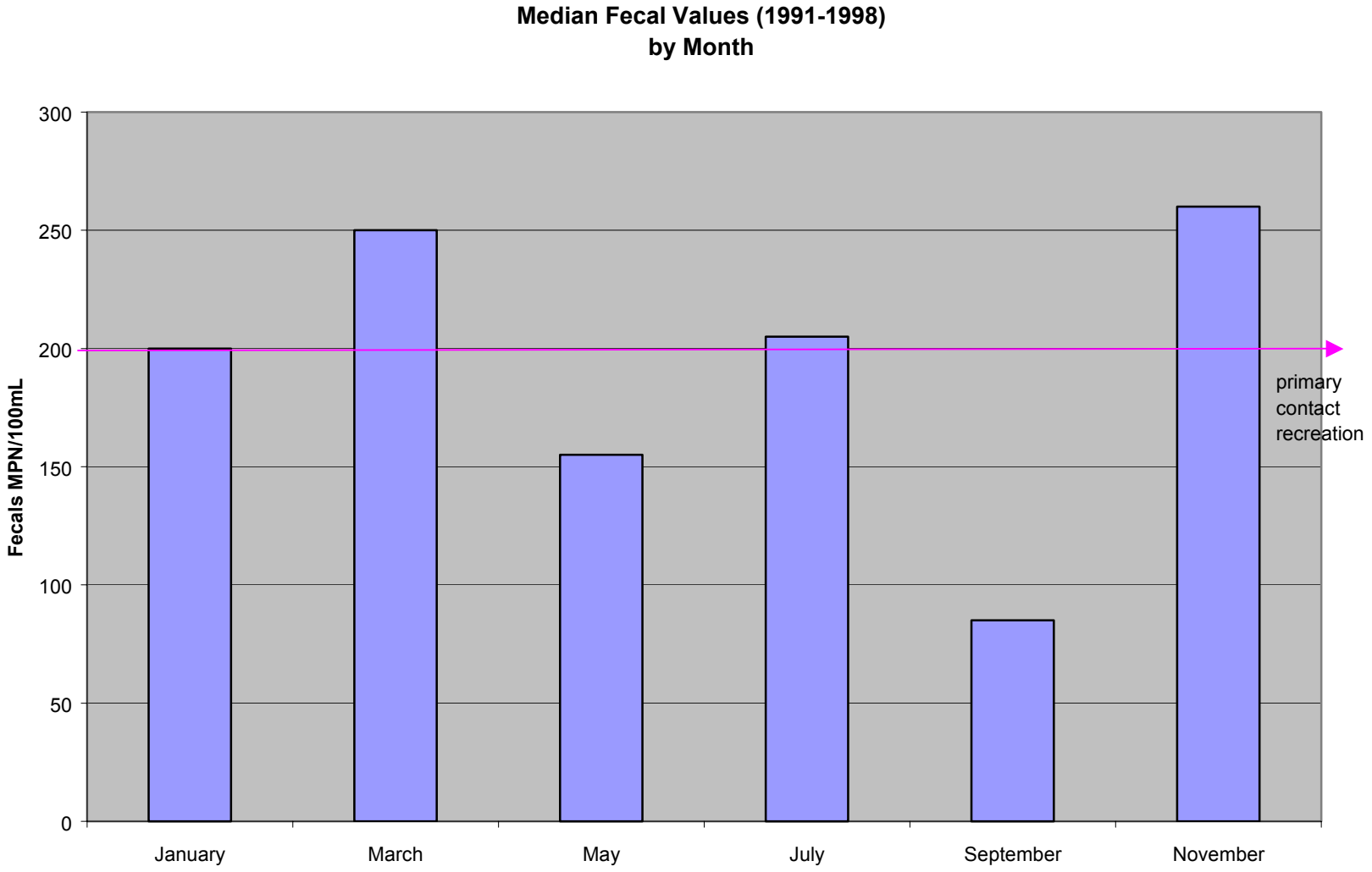
"Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

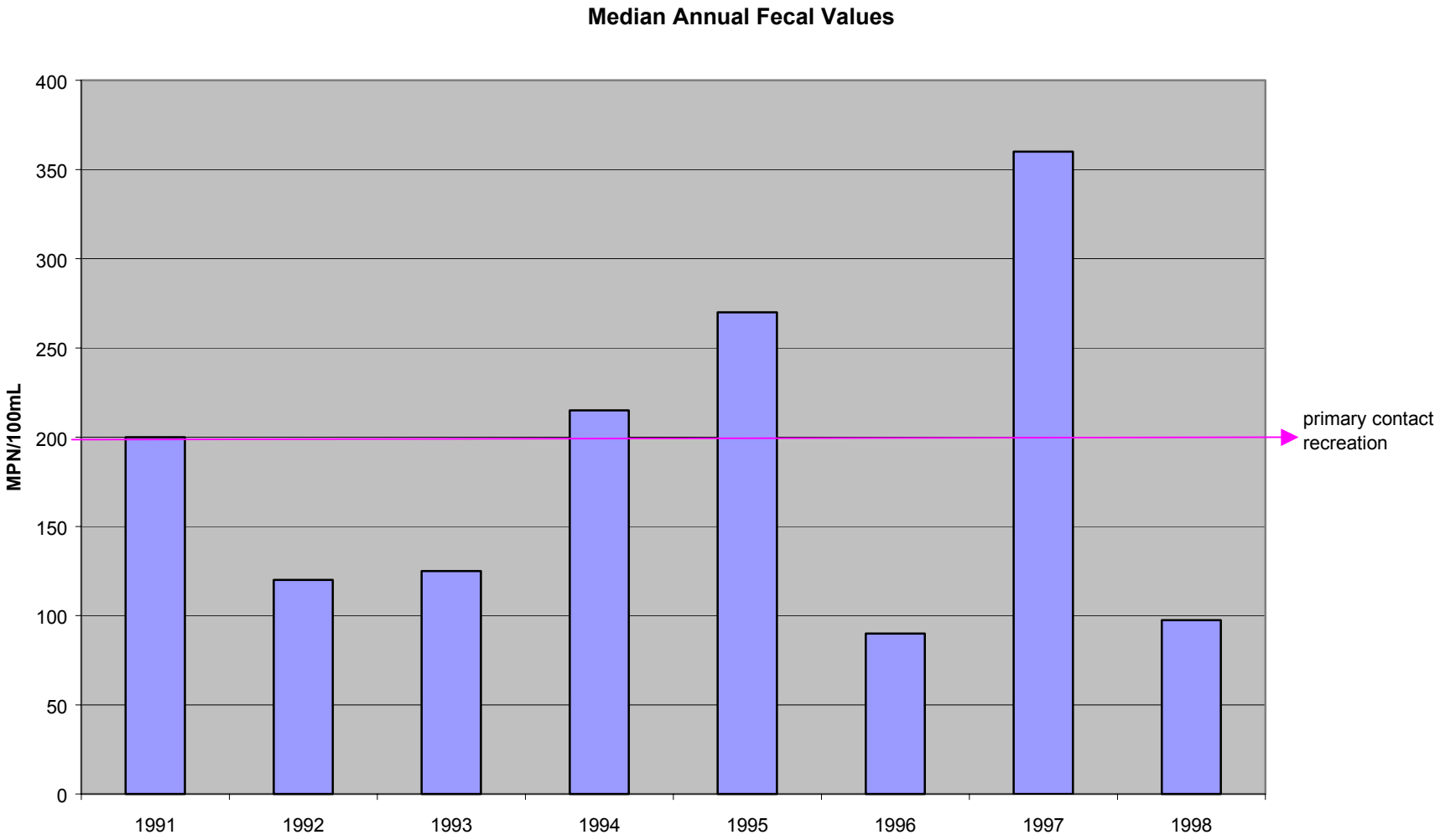
The standard for secondary contact recreation reads similarly:

"Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

In development of this TMDL, data for all seasons were evaluated. Five years (January 1994 – December 1998) of monthly LDEQ monitoring data on Bayou Des Cannes (collected northeast of Jennings) were assessed to determine if the primary and secondary contact recreation uses were being maintained. Analysis of the data for the November – April season showed that the secondary contact recreation use was being maintained.

Analysis of the data for the May – October season showed that the primary contact recreation use was not protected. Therefore, a TMDL was developed to protect the May – October season. The monthly fecal coliform counts, in colony forming units (CFU), for the summer season went as high as 1,300 cfu/100ml over the 5-year period 1994 – 1998 (USEPA, 2001). The load reduction needed to meet the water quality standard for primary contact recreation in Bayou Des Cannes was determined to be 35%.


Median Fecal Values (1991-1998)
by Month
Fecals MPN/100mL
300
250
200
150
100
50
0
January
March
May
July
September
November
primary
contact
recreation


Median Annual Fecal Values
MPN/100mL
400
350
300
250
200
150
100
50
0
1991
1992
1993
1994
1995
1996
1997
1998
primary contact
recreation

Pesticides (Fipronil)

A TMDL was also developed by the USEPA for the pesticide Fipronil. This insecticide has proven effective in controlling the rice weevil. However, since it came into use in 1999, crawfish production has declined (USEPA, 2002). The relationship between crawfish toxicity and Fipronil is still under study. Although strict causality has not been determined, anecdotal evidence supports the possibility that Fipronil is detrimental to the crawfish harvest.

The only source of Fipronil in the Bayou des Cannes watershed is its use in rice farming. It is only by developing and utilizing BMPs specific to rice production that its effects may be checked.

Turbidity

Sediment is a major pollutant generated by all manners of land use activities. This material can settle over large areas, where it blankets the stream bottom, and/or may become resuspended in the water column. Turbidity increases and water organisms are affected. Sediment particles may harbor harmful bacteria, pathogens, pesticides and metals. These pollutants may be redistributed as the sediment is transported. As sediments resuspend, these materials can reenter the water column and become an uncontrolled source of pollutants. The problem can be a very severe one.

Bayou des Cannes has been subsequently de-listed for oil and grease (on 05/23/01) and turbidity (on 04/05/01). At the time of this writing, the Bayou was found to be meeting water quality standards for these pollutants.

Review of TMDL Development Study

There are 29 facilities discharging sanitary wastewater into Bayou des Cannes and its tributaries. The TMDLs found that virtually all of the point source dischargers in the modeled area were either too small or too far away to have a significant impact upon the watershed model. Limits for these small dischargers are generally set by state policy. Only one, the Town of Iota STP, was considered to have a potential impact on Bayou des Cannes. Although the city of Eunice is a large discharger, it was found to have no effect upon water quality in des Cannes.

The final design of the TMDL designated eight reaches and included six tributaries of Bayou des Cannes. Two of these tributaries were also incorporated as reaches and were therefore handled as discrete point source dischargers. These two tributaries, unique from the other four tributaries, were Bayou Barwick and Point Aux Loup.

A Use Attainability Analysis was approved for the Mermentau River Basin in 1998. D.O. recommendations for the bayous in the Mermentau River Basin were assigned seasonally as 5 mg/L (December – February) and 3 mg/L (March – November). These D.O. recommendations were based on the existing D.O. criteria for similar waterbodies in the lower Calcasieu River Basin. The recommendations allow for protection of the full fish and wildlife propagation use.

It is believed that naturally dystrophic water bodies, though seasonally deficient in D.O., may fully support fish and wildlife propagation and other water uses (Day et al, 1987). Low dissolved oxygen concentrations (less than 5 mg/L) may occur seasonally during the warmer months of the year in naturally dystrophic water bodies (LAC 33:IX.1109.C.3.a).

The water quality standard for dissolved oxygen during the summer months is 3.0 mg/L. The LDEQ TMDL for Bayou des Cannes indicated that this standard could be maintained during the summer critical season with some adjustments. A 50% reduction from all manmade nonpoint sources in the upper majority, Reaches 1 – 6, of the Bayou would be required. Reaches 1 - 6 roughly correspond to the northern 46 miles of the modeled watershed and encompass the modeled tributaries: Tiger Point Gully, Richard's Gully, Bayou Barwick and Bayou Mallet. A 75% reduction from all manmade nonpoint sources in the lower minority, reaches 7 – 8, of the waterbody would also be needed. This is approximately the southern 14 miles of the modeled watershed and encompasses tributaries Point Aux Loup and Bayou Plaquemine Brule. In addition, it was advised that treatment levels be upgraded to effluent reaeration at the Iota STP during the summer months. The imposition of post reaeration while maintaining current limits of 10 mg/1 $CBOD_5$/10mg/1 NH_3 was recommended.

The water quality standard for dissolved oxygen during the winter months is 5.0 mg/L. The winter projection model showed that this criterion could be maintained during the winter critical season for the entire watershed with some adjustments. A 50% reduction from all manmade nonpoint sources in Reaches 1 - 6 (see location above) of Bayou des Cannes and a 75% reduction from all manmade nonpoint sources in Reaches 7 – 8 (see location above) of the Bayou would be necessary. The imposition of 10 mg/1 $CBOD_5$/10 mg/1 NH_3/2 mg/1 D.O. limits would also be needed at the Iota STP for the winter months.

In order to meet the reductions specified in the TMDL, failing septic systems should be identified and corrected, and livestock should be excluded from streams. In addition, all functional septic systems need to be maintained. It was also advised that LDEQ work with other agencies such as local Soil and Water Conservation Districts to implement agricultural best management practices in the watershed through the 319 program. LDEQ will also continue to monitor the waters to determine if standards are being attained.

Summary of the LDEQ TMDL for D.O. included:

- 50 and 75 % reductions in manmade nonpoint source loads in the watershed
- upgrade treatment levels at the Iota STP during the summer months
- implementation of agricultural BMPs through the 319 programs

Federal Authority

Section 319 of the Clean Water Act (PL 100-4, February 4, 1987) was enacted to specifically address problems attributed to nonpoint sources of pollution. Its objective is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Sec. 101; PL 100-4), which instructs the Governor of each State to prepare and submit a Nonpoint Source Management Program for reduction and control of pollution from nonpoint sources to navigable waters within the State by implementation of a four-year plan (submitted within 18 months of the day of enactment).

State Authority

In response to the federal law, the State of Louisiana passed Revised Statute 30:2011, signed by the Governor in 1987 as Act 272. Act 272 designated the Louisiana Department of Environmental Quality as the "Lead Agency" for development and implementation of the State's Nonpoint Source Management Plan. The Louisiana Revised Statutes R.S. 30:201.D (20) include the following provision as the authority for LDEQ to implement the State's NPS Program:

To develop and implement a non-point source management and ground water quality protection program and a conservation and management plan for estuaries, to receive federal funds for this purpose and provide matching state funds when required, and to comply with terms and conditions necessary to receive federal grants. The nonpoint source conservation and management plan, the groundwater protection plan, and the plan for estuaries shall be developed in coordination with, and with the concurrence of the appropriate state agencies, including but not limited to, the Department of Natural Resources, the Department of Wildlife and Fisheries, the Department of Agriculture and Forestry and the State Soil and Water Conservation Committee in those areas pertaining to their respective jurisdictions.

Watershed Description

Bayou des Cannes is a perennial stream located in southwestern Louisiana in the Mermentau River Basin. It originates in Evangeline Parish, south of Miller's Lake, and flows in a southwesterly direction through Acadia Parish to its termination at the confluence of the Bayou with the Mermentau River. Only the lower Bayou des Cannes watershed, an area 54 miles in length, was included in the 1999 study. (The upper reaches of the Bayou were not modeled because it was determined that they had been largely channelized and otherwise permanently altered.)

Bayou des Cannes is tidal in nature, with frequent flow reverses. The Bayou is very deep, wide and sluggish, especially at low flow (LeBlanc, 1999). The predominant slope is less than 1 percent; the maximum slope excluding stream banks is about 3 percent.

This TMDL model is comprised of Bayou des Cannes as the main stem with several tributaries. The six tributaries that were included in the development of the 1999 TMDL are Tiger Point Gully, Richard's Gully, Bayou Barwick, Bayou Mallet, Point Aux Loup, and Bayou Plaquemine Brule. (TMDLs were also developed for Bayous Mallet and Plaquemine Brule in separate surveys conducted by LDEQ/USEPA.)

The landscape of the watershed is the low relief prairie common to southwest Louisiana, interspersed with wetlands and riparian trees along the streambeds. Original vegetation was a mixed forest of pines and hardwoods (USDA, 1962) along with grasses, rushes and sedges.

The highly acidic soils of the Bayou des Cannes watershed consist of gray and light gray loamy surface layers with a clayey subsoil. This clayey subsoil is slowly drained and sometimes impermeable (USDA, 1974). The climate is warm, humid and subtropical. Average annual precipitation in the watershed is approximately 57 inches. Elevations range from mean sea level along the watercourse to about 60 feet above mean sea level.

The main urban areas near Bayou des Cannes include Eunice, Basile, Iota, Estherwood, Jennings, Evangeline and Egan. None of these population centers has more than 25,000 inhabitants.

Land use is mostly agricultural with some forestland and wetland. Only a small percentage of the land has been urbanized. Most of the land in the watershed is privately owned.

LAND USE TYPE	NUMBER OF ACRES	% OF TOTAL AREA
Urban	4,092	2.55
Barren Land	86	0.05
Agricultural	121,401	75.75
Forest Land	18,853	11.76
Water	3,209	2.00
Wetland	9,055	5.65
Rangeland	3,561	2.22
Other	32	0.02
TOTAL AREA	160,257	100

From the TMDL, LDEQ (November, 1999)

Description of Ecoregion

The entire Mermentau River Basin lies within the Western Gulf Coastal Plain ecoregion. Streams within the same ecoregion are expected to exhibit the same ecological characteristics such as climate, land surface forms, soils, water quality and vegetation (Omernik, 1987, as cited in Office of Water Resources, 1998). Waterbodies within the same ecoregion may be compared physically, hydrologically, and biologically to determine regionally attainable conditions.

Designated uses by Subsegment

Designated water uses for the Mermentau River Basin streams (including Bayou des Cannes) are proposed to remain as primary and secondary contact recreation, propagation of fish and wildlife, and agriculture.

Agriculture

As agriculture is the dominant land use in the area (over 75%), it is a primary contributor of nonpoint source pollution. The potential long-term effects of agricultural pollutants include high concentrations of nitrogen, phosphorus, sediments, turbidity, and pesticides in water bodies. Common agricultural practices such as fertilizer application and soil tillage may increase sediments and pollutants in runoff.

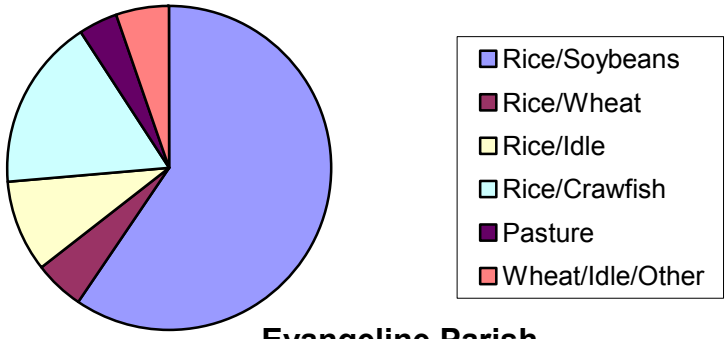
The numbers in the table below are estimates of the number of acres devoted to each type of agriculture within the Bayou des Cannes watershed. Land use is dynamic and therefore these numbers may vary each year.

Land Use	**Parish**			
	Evangeline	Acadia	St. Landry	Totals
Rice		13,830	3,240	17,070
Rice/Soybeans	42,600			42,600
Rice/Wheat	3,670			3,670
Rice/Idle	6,500			6,500
Rice/Crawfish	12,410			12,410
Pasture	2,940	5,630	1,580	10,150
Wheat	1,370			1,370
Sugarcane	220	540		760
Soybeans	180	1,860	1,810	3,850
Milo		1,340		1,340
Corn		40		40
Cotton	130			130
Sweet Potatoes	460			460
Hay		60		60
Idle	1,340	15,620	1,590	18,550
Crawfish		6,560	1,020	7,580
Catfish		480		480
Totals	71,820	45,960	9,240	127,020

Land-use data provided by the Office of Soil and Water Conservation

Soybeans and crawfish are produced in the area, although the dominant crop grown is rice. In 1999 and 2000, Acadia Parish was the top rice producer in the state and Evangeline Parish the fourth largest rice producer (Louisiana Agricultural Statistics Service). Rice may be planted in a dry seedbed or in water. In both types of planting methods, BMPs can be utilized to reduce runoff and associated pollutants. Separate BMPs exist for wet-seeded and dry-seeded fields.

Rice planting, in particular, has been associated with large and turbid discharges into local waterways. Much soil may be lost from rice fields when the irrigation waters are drained. In the Bayou des Cannes watershed, rice is usually grown under flooded conditions as its relatively flat lands, underlain with impervious claypan, are well suited for holding water. It may be stated that an efficient use of the funds available to restore Bayou des Cannes would be to cost-share with rice farmers on rice best management practices.



Evangeline Parish

One way to control and reduce runoff of soil and oxygen-demanding pollutants is for farmers in the watershed to adopt best management practices (BMPs). In this way nutrient loadings from agricultural sources might be reduced and TMDL objectives may be met in the watershed.

Louisiana's Nonpoint Source Management Program has demonstrated that implementation of rice best management practices will successfully reduce both solids and organic carbons (LDEQ, 2000). In the early 1990s, under the tutelage of an interagency working group, 107 rice farmers in Vermilion and Acadia parishes participated in a project to evaluate management practices. Four management practices for rice were developed and evaluated as methods to reduce the amount of sediment leaving the fields. These four management practices were: (1) water planting in previous crop residue; (2) retention of floodwater in a closed levee system for a specified period during and after soil-disturbing activities (i.e.: mudding-in); (3) clear water planting into a prepared seedbed; and (4) use of a vegetated filter area.

Of the 107 participants, 91 of them selected management practice (2). It was found that 50 – 90% of soil solids settled out during a 15-day holding period (LDEQ, 2000). Louisiana Cooperative Extension Service developed a simple test kit that enabled the

rice farmer to estimate the amount of sediment in irrigation water. Minimizing run-off also minimizes soil loss from the farmer's field, a benefit to the individual.

Silviculture

Forestry, at 11.76%, is significant and the second most common land use in the Bayou des Cannes watershed. Silviculture is also one of the suspected causes of nonpoint source pollution.

The cultivation, harvest, and transport of lumber may have detrimental effects upon a waterbody. These include problems with organic enrichment/low D.O. and suspended solids, as cited on the 1999 §303(d) List.

The main effect of silviculture is erosion. In areas of heavy logging, concentrations of sediment and suspended solids typically increase in water bodies. Pesticides, herbicides, and fertilizers also run off and accumulate in the water body, often adhering to the suspended solid particles. Organic matter and woody debris may clog the streambed, slowing flow rates. Stream temperatures increase as overhanging trees are removed from stream banks. Without forestry BMPs, it becomes more likely that there will be an increase in nutrient enrichment and a decline in dissolved oxygen.

Road building is integral to silviculture and poses a great threat to forested watersheds, especially fish habitat. Road cuts, ditches and shoulders generate stream sediment, which may smother streambeds. Stream crossings and culverts can block fish from moving up and down stream. Roads may also introduce fuel, pesticides, and other toxins into streams as well as accelerate erosion.

Extra caution should be used when harvesting timber from along the riparian corridor. The vegetation found within this streamside management zone serves as a natural filter for the water body. Specific BMPs are recommended so that the streamside management zone is not compromised during harvest activities.

Recommended BMPs include the use of portable bridges for temporary stream crossings. This will have less impact on the waterway than the full-blown construction of a permanent structure. The temporary bridge crossings should be completely dismantled and removed after the harvest is complete.

Trees should not be removed from banks or steep slopes if such removal will destabilize soil and degrade water. It is frequently the root systems of trees and large shrubs that anchor and secure the sides of the waterway while preventing erosion. Harvesting should also be limited during wet periods when forested wetlands are more sensitive to impact.

Home Sewerage

A significant portion of Louisiana's nonpoint source pollution can be attributed to home sewerage. It is estimated that 1,323,600 people in Louisiana treat and dispose of their sewerage with individual waste disposal systems, and that over 50% of these systems are malfunctioning because of incompatible soil types or lack of maintenance (LDEQ, 2000). These failing systems are a significant source of water quality degradation in Louisiana's scenic streams and fresh water aquifers. Bayou des Cannes has been listed on Louisiana's §303(d) Lists of Impaired Waters as not meeting its primary contact recreation uses due, in part, to fecal coliforms.

There are numerous rural residences in the Bayou des Cannes watershed. Most of these homes and camps are not connected to municipal sewage treatment facilities. This lack of central sewage treatment has undoubtedly caused a decline in water quality. Current records on individual treatment systems are often incomplete. Many systems were installed prior to the permit requirement, many are obsolete and some lack treatment systems altogether.

Actions recommended by LDEQ to mitigate the negative effects of home sewerage are found in Louisiana's Nonpoint Source Management Plan, Volume 6 (2000). These include:

- Continue to work with the Louisiana Department of Health and Hospitals (LDHH) on programs to support improved inspection programs for home sewerage systems;
- Continue to work with LDHH on educational materials that can improve the statewide education program for home sewerage systems;
- Support the incorporation of the results of these inspection programs into a comprehensive database on home sewerage systems;
- Continue to seek and evaluate new, more effective technologies for individual home sewerage systems; and
- Continue to track results of the statewide educational program and tracking system in order to determine whether fecal coliform bacteria is decreasing in areas of the state where water bodies are impaired by nonpoint source pollution from home sewerage systems.

Urban Runoff

The major problem created by urban storm water runoff is degradation of those waters that receive the runoff. Receiving waters may be bayous and rivers or they may be drainage ditches that eventually empty into bayous and rivers. Studies show that the highest pollutant loading during rainfall events usually occurs in the first runoff of rain, commonly referred to as the "first flush." Most of the pollutants that have accumulated between rainfall events are washed away with the first inch of rainwater.

In nature, much of the rainwater will percolate downward through the soil and some of this will be picked up by existing vegetation. Excess runoff will also pond in natural depressions in the landscape, where some of it will evaporate. With increasing population density, there is less area for detention and infiltration of runoff waters. Impervious areas such as graded streets, parking lots and rooftops become more common. These impenetrable surfaces allow little infiltration of storm water. Instead, they act as a conduit for the water that runs off of them. Pollutants found in urban runoff include contaminants from the air, petroleum and exhaust residues from automobiles, lawn fertilizers, toxic metals and sediment from construction sites.

Actions recommended by LDEQ to mitigate the negative effects of urban runoff are found in Louisiana's Nonpoint Source Management Plan, Volume 6 (2000). These include:

- Continue to distribute educational materials to the urban areas across the state that have been identified as contributing to nonpoint source water quality problems;
- Continue to develop and utilize new educational materials, tools, and videos that have proven to be effective in other cities within the state and across the nation;
- Continue to work with city planners, engineers, developers and builders on innovative designs that incorporate urban forests, wetland detention areas and other environmentally sensitive practices that can effectively reduce urban pollutants from entering the water bodies;
- Continue to work with the parish drainage boards, NRCS and the Corps of Engineers on stream bank protection and restoration along urban streams;
- Continue to monitor the water bodies through the 5-year basin cyclic monitoring program in order to determine if the steps that have been taken to implement the urban BMPs have been effective in improving water quality; and
- Continue to work with local governments on development and implementation of the types of ordinances that may be necessary to achieve full compliance with Phase I and II of the Storm Water Regulations and the goals and objectives of the state's NPS Management Program.

Hydromodification

Hydrologic modifications are those activities that are designed to alter the natural stream flow. Modifications include dredging, bank stabilization, locks and dams, levees, spillways, channel alignments, and in-stream construction. These activities may be conducted for purposes of navigation or flood control. A permit program, administered by the United States Army Corps of Engineers, oversees many of these modifications. All hydrologic modification has the potential to cause water quality problems.

Actions recommended by LDEQ to mitigate the negative effects of hydromodification are found in Louisiana's Nonpoint Source Management Plan, Volume 6 (2000). These include:

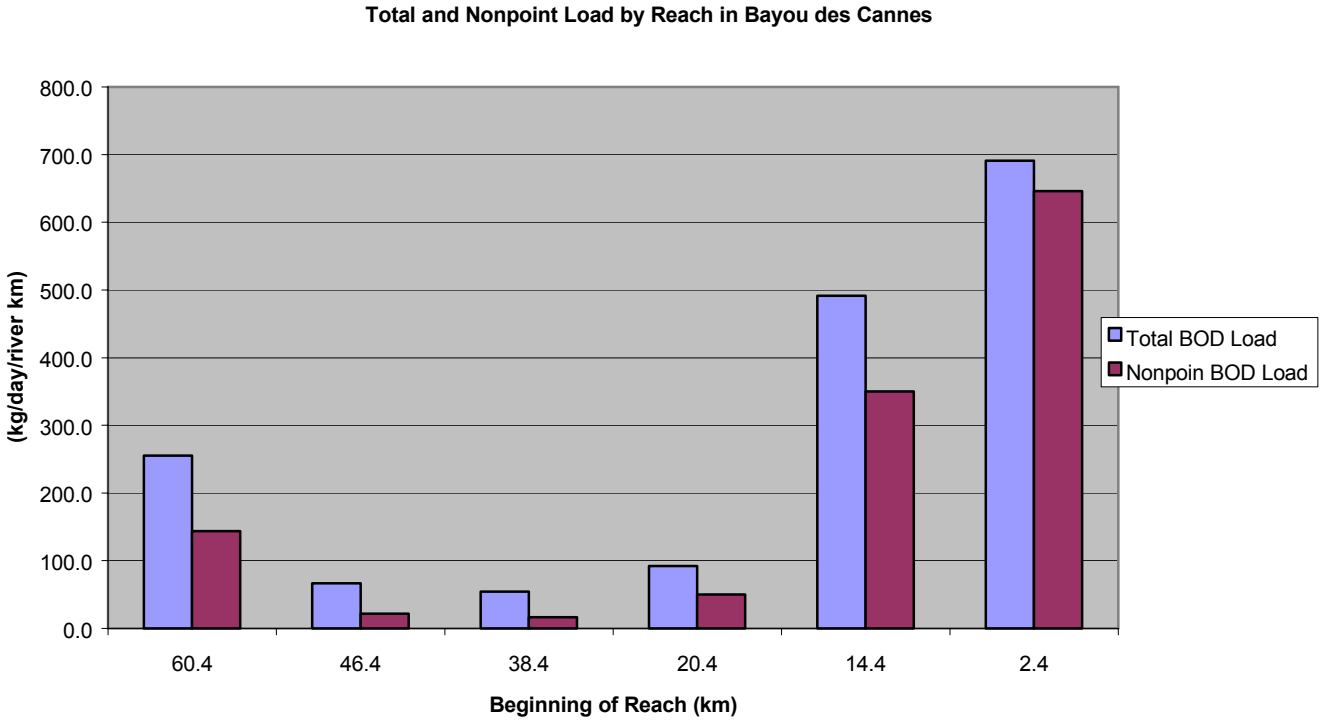
- Work with USDA to host a workshop on Stream Corridor Restoration;
- Develop partnerships with local drainage boards, police juries and conservation districts to implement these restoration strategies within watersheds that have been impaired by stream bank and channel alteration;
- Implement a project where these restoration strategies are utilized as a method to improve aquatic habitat;
- Track the implementation rate of these methods through Local Soil and Water Conservation Districts, NRCS, and other local entities;
- Measure water quality improvement through improved habitat, biological communities, and chemistry of the water in areas where the restoration techniques have been implemented;
- Utilize the federal, state and local regulations, laws and ordinances that are applicable to requiring that BMPs be incorporated in to 404 and 401 projects, so that the impact of hydromodification on the state's water bodies might be reduced; and
- Coordinate the LDEQ program with that of the Louisiana Department of Natural Resources, Coastal Management Division.

Tributaries

The following graph indicates that much of the pollutant loading in des Cannes occurs between River Kilometers 14.4 and 2.4. River Kilometer 2.4 roughly corresponds to the confluence of Bayou Plaquemine Brule with des Cannes and the Mermentau River at the southern terminus of subsegment 050101 (Bayou des Cannes). It might be expected that a great deal of churning activity here would resuspend much of the benthic load. It may also be a meeting of three waters, with the effects of pollution therefore magnified.

River Kilometer 14.4 is approximately at the confluence of the tributary Point Aux Loup with des Cannes. This is north of the confluence in the preceding paragraph and likely subject to unique stressors.

It might also be noted that these two reaches are the southernmost faction of Bayou des Cannes, immediately prior to its confluence with the Mermentau. These reaches likely represent the most sluggish and tidally influenced part of the Bayou. It is possible that natural conditions account for some of the increased loadings.

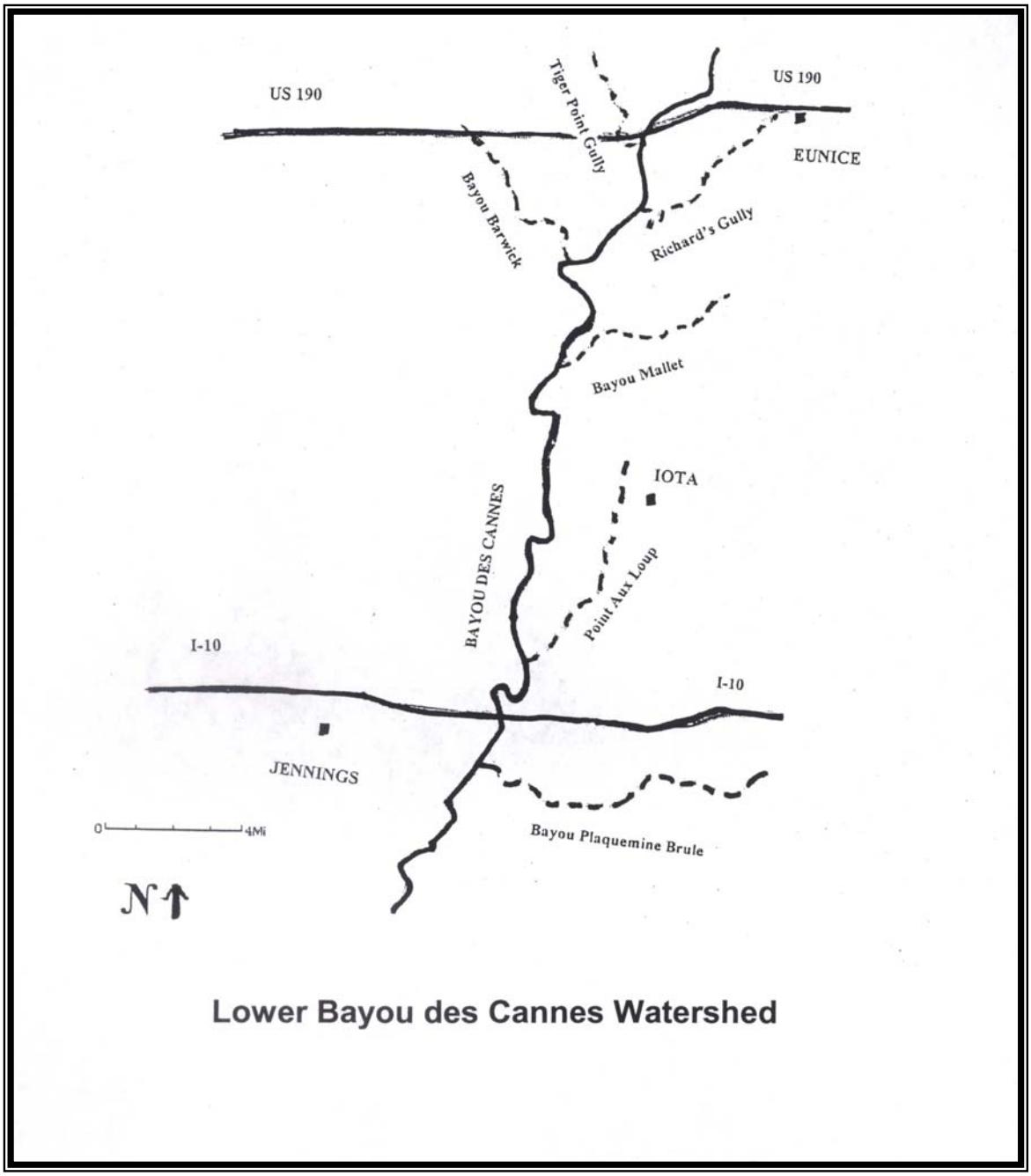


The six tributaries are described briefly below, in order from north to south.

Tiger Point Gully
Tiger Point Gully is the northernmost tributary and empties into Bayou des Cannes from its northwesterly path.

Richard's Gully
Richard's Gully flows to the east of Bayou des Cannes, in a meandering northeast-southwest alignment. Richard's Gully flows through the urban center of Eunice, approximately one and a half miles from its confluence with Bayou des Cannes. Richards Gully has undergone much alteration by man.

Bayou Barwick
Bayou Barwick is located to the west of Bayou des Cannes and flows in a northwest-southeast pattern. Bayou Barwick and its confluence with des Cannes comprise the whole of Reach 2 in the TMDL model. The actual main stem of Bayou Barwick was included in this TMDL because of one of its permitted dischargers, Enron. Later findings indicated that Enron did not have a significant impact upon water quality in des Cannes. Nonetheless, Bayou Barwick was sampled during survey and the resulting data were entered into the TMDL model as a discrete wasteload.



Lower Bayou des Cannes Watershed

Bayou Mallet
Bayou Mallet enters des Cannes from the east. Bayou Mallet has been cited on the 303(d) List in the past. A separate TMDL model has been developed for Bayou Mallet.

The City of Eunice Sewer Treatment Plant (STP) empties into an Unnamed Tributary to Mallet. The STP provides all flow to this tributary (except when excessive runoff occurs during rain events). It has been found that the STP-related sag in D.O. occurs and recovers before this tributary reaches Mallet**.**

However, potentially toxic ammonia nitrogen concentrations have been noted in the Unnamed Tributary at Eunice and in Bayou Mallet downstream of the Unnamed Tributary at Eunice. The high ammonia nitrogen concentrations were the result of the influence of the City of Eunice STP. It is not known if the problems with ammonia extend to Bayou des Cannes.

Point Aux Loup
Point Aux Loup empties into des Cannes from the east. There has been some channelization of des Cannes in this area. This is near the Jennings Oil and Gas Field, which lies to the west of des Cannes, near its confluence with Point Aux Loup. The main stem of Point Aux Loup and its confluence with des Cannes comprise the whole of Reach 6 in the TMDL model. Like Bayou Barwick, Point Aux Loup was sampled during survey and the resulting data were entered into the TMDL model as a discrete wasteload. One discharger, the City of Iota Sewer Treatment Plant (STP), is located on this tributary.

Bayou Plaquemine Brule
Bayou Plaquemine Brule is the last and southernmost tributary analyzed. It is located to the east of des Cannes and terminates at its junction with Bayou des Cannes and the Mermentau River. Bayou Plaquemine Brule has been cited on past §303(d) Lists as not meeting the water quality standard for dissolved oxygen. It has also been listed as impaired due to nutrients. Separate TMDL models have been developed for Plaquemine Brule. An implementation plan has also been completed for this waterbody.

The section of Plaquemine Brule included in this survey is meandering, sluggish, shallow, and bounded by swamps. The topography is nearly level, predominant slope is less than 1 percent, with a maximum slope of approximately 3 percent. Further north of the survey area, Plaquemine Brule becomes highly agricultural and passes through populated areas. It may be supposed that some of these impacts are carried down to the study area.

In 1915, the Bayou was channelized from its mouth, where it joins the Mermentau, to a point near Crowley, Louisiana (USACE, 1979, as cited in Office of Water Resources, 1998). Flood control management has required repeated dredging to allow for continued development in the drainage basin. This hydromodification has created a uniform water depth in the Bayou, reducing the flow gradient and velocity. High retention times have resulted in increased deposition and sedimentation of most suspended material (Office of Water Resources, 1998). The entire reach of the Plaquemine Brule that was part of the 1999 des Cannes TMDL is maintained as a strict navigation channel.

Nonpoint Source Management Plan

The 303(d) Lists provide information on which water bodies are impaired or not in full support of their designated uses. Those listed, impaired water bodies are then scheduled for TMDL development. Water bodies can be delisted, or removed from the 303(d) list, because new data indicate that the water body is meeting its designated uses *or* because the TMDL has been developed.

The 305(b) Report is a summary of the water quality status for each of the water bodies throughout the state. A water body remains on the 305(b) Assessment as impaired even after the TMDL has been developed. The impairment status of a water body only changes if the water quality data indicate an improvement (or decline) in water quality.

The future objective for the Mermentau River Basin is the continuance of work with federal and state agricultural agencies, as well as the local Soil and Water Conservation Districts, on implementation of BMPs for rice, crawfish, soybeans, sugarcane and pastureland management. Much of the focus will be on the Bayou Plaquemine Brule Watershed (a tributary to des Cannes and a particularly troubled waterbody). It is hoped that the findings here may prove beneficial when applied to the other waterbodies in the Mermentau River Basin.

Specific guidelines laid out in Louisiana's Nonpoint Source Management Plan, Volume 6 (2000) are:

- Implement the Watershed Restoration Action Strategy (WRAS) for the Bayou Plaquemine Brule Watershed and track its progress in reducing sediments, nutrients and fecal coliforms to the Bayou;

- Determine whether the WRAS has been successful in improving water quality within the Bayou and restoring the designated uses of fishing and swimming;

- Work with the federal, state and local agencies on additional measures that could restore these uses if the initial implementation efforts are not successful;

- Continue the implementation process until the Bayou does meet the water quality standards and designated uses;

- Transfer the process to Bayou Nezpique, Bayou Des Cannes, and the Mermentau River, and track the rate and level of pollutant reduction and water quality improvements;

- Continue to adjust the BMPs and management options (both voluntary and regulatory) until the water bodies across the Mermentau River Basin are meeting the water quality standards and their designated uses for fishing and swimming are restored; and

- Report progress made in BMP implementation, nonpoint source pollutant load reduction and water quality improvement to EPA on an annual basis.

It is the objective of LDEQ to restore designated uses to those waterbodies of the Mermentau River Basin Watershed that were listed on the 1998 303(d) list of impaired waters. LDEQ's monitoring program, combined with localized watershed monitoring, will be the basis to track progress made in reaching these water quality goals. Through this implementation process, water quality within the Basin is expected to improve.

Program tracking will be done at several levels to determine if the watershed approach is an effective method to reduce nonpoint source pollution and improve water quality in the Mermentau River Basin:

- Tracking of actions outlined within the Watershed Restoration Action Strategy;

- Tracking of BMPs implemented as a result of Section 319, EQIP, and/or other sources of cost-share and technical assistance within the watershed;

- Tracking progress in reducing nonpoint source pollutants (such as solids, nutrients, and organic carbon) from the various land-uses (rice, soybeans, crawfish farms) within the watershed;

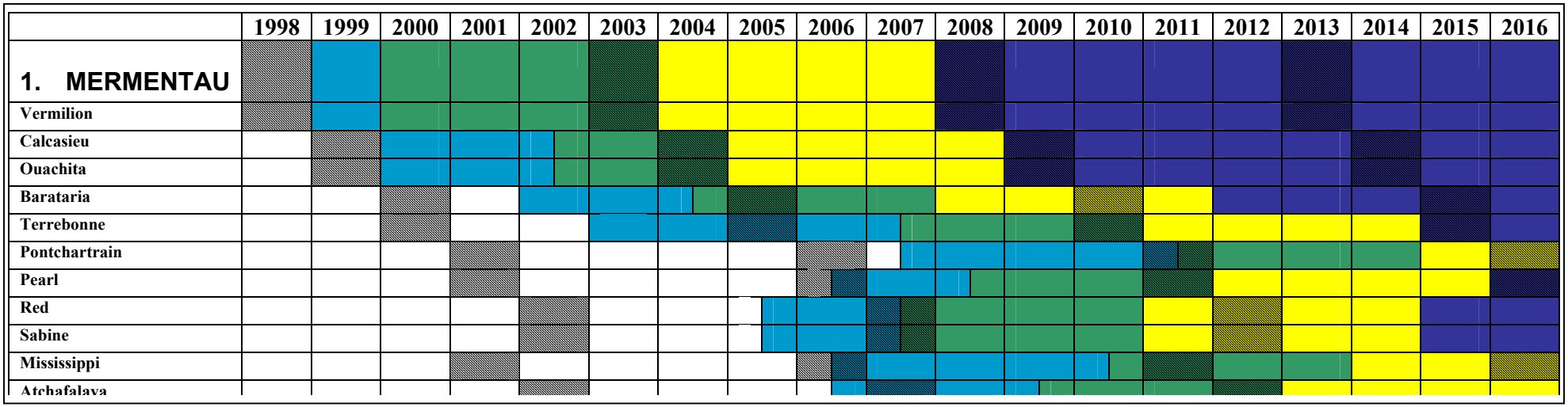
- Tracking water quality improvements in the waterbodies (i.e.: decreases in total organic carbon, total dissolved and suspended solids, total nitrogen, total phosphorus, and increases in dissolved oxygen);

- Documenting results of the tracking to the Nonpoint Source Interagency Committee, residents within the watershed, and EPA;

- Submitting semi-annual and annual reports to EPA which summarize results of the watershed restoration actions; and

- Revising LDEQ's web-site to include information on the progress made in watershed restoration actions, nonpoint source pollutant load reductions, and water quality improvement in the waterbodies.

Timeline for Watershed Implementation



1- Dark Grey = Collect Water Quality Data to Develop the Total Maximum Daily Loads (TMDLs)
2- Turquoise = Develop the Total Maximum Daily Load for the Watersheds on the 303(d) list
3- Green = Develop Nonpoint Watershed Restoration Action Strategies
4- Yellow = Implement Nonpoint Watershed Restoration Action Strategies
5- Light Grey = Determine Whether Actions Have Been Successful in Restoring Designated Uses
6- Blue = Develop and Implement Additional Corrective Actions Necessary to Restore Designated Uses to the Water Body

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